Representative Task # 1

Precision Orbit Determination for Altimetry and Other Satellites (based on 1.4)

For the purposes of costing, assume that this Representative Task runs for Years 1 through 4 of the contract and the work is to be performed off-site.

Background:

Satellites that carry a radar or a laser altimeter have stringent requirements to determine the orbit as precisely as possible. The requirement for the Jason series of missions (Jason-1, Jason-2, and the future Jason-3) is 1 cm overall radial orbit error. Over the 14 years of the TOPEX/Poseidon mission, the orbits were determined to a precision of 1.5 to 2.0 cm. A number of factors come into play to determine the ease with which this goal can be met: (1) the fidelity of the force models; (2) the quality and distribution of the tracking data; (3) the stability of the reference frame; (4) The reliability and accuracy of models and strategies for correcting the data for troposphere or ionosphere refraction; (5) the accuracy of data-specific corrections (e.g. phase-windup and antenna phase maps for GPS and GPS-user satellites). In the absence of continuous tracking, altimeter crossovers can serve as a valuable independent data type. In addition, the altimeter crossovers can serve to validate orbit performance and orbit improvements. The ability to compute reduced-dynamic and dynamic orbits with different data types, SLR, DORIS, GPS, and inter-compare the resultant orbits, is an essential tool to meet the one cm goal of precise orbit determination. With the Jason-1, Jason-2, Jason-3 and GFO-2 type of mission, there is a strong emphasis on operational oceanography and the rapid delivery of orbit and altimeter products. Strategies need to be developed to deliver medium precision orbits with a suitable accuracy and latency.

The Earth's gravitational field is of paramount importance among the force models, the gravity field research at GSFC can be divided into two areas: (1) improvement of the model for the static gravity field and associated geoid, and (2) measurement of the time variations of the gravity field due to both tidal forces as well as variations caused by non-tidal mass redistribution in the atmosphere, hydrosphere, and solid Earth.

Technical Requirements

The contractor shall:

1. Process geodetic tracking data to user altimeter satellites (TOPEX, GFO, Jason-1, Jason-2, ICESAT, DESDynI), using the best possible parameterization, measurement and force modeling. This includes the latest time-varying gravitational models as determined independently from missions such as GRACE and CHAMP, as well as the latest static models and associated geoids.

2. Analyze, validate and inter-compare orbits of Jason-1 and Jason-2 produced at GSFC with the products of external analysis centers, such as CNES, JPL, and ESOC.

3. Implement and test the ITRF2008 realization of the terrestrial reference frame, and further refinements to measurement and force modeling, to produce refined orbits for GEOSAT, GFO, Topex, Jason-1 and Jason2.

4. At the end of the Period of Performance, a report will summarize trade between latency and orbit accuracy for current (Jason-1, Jason-2) and future missions (Jason Follow-Ons, SWOT).

5. No specific operational orbits are required for DESDynI since indeed the satellite will not be in orbit during the period of performance for this task, however pre-launch studies of the principal orbit error sources and how to mitigate them is to be considered. A report shall be produced detailing the principal error sources and how best to mitigate them with the tracking data expected from DESDynI.

6. Provide summaries of mission tracking for meetings of the International Laser Ranging Service (ILRS), and International DORIS Service (IDS). Assume that the meeting takes place in Toulouse, France.